

The Bisexual generation of *Diplolepis disticha* Htg. (Cynipide)

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In Holland occur five species of the genus *Diplolepis* e.g. *folii* L., *longiventris* Htg., *divisa* Htg., *disticha* Htg., and *agama* Htg. *Folii* was named by Westwood, in 1840, as type of the genus *Cynips* of Linnaeus, but later Dalla Torre and Kieffer (1910) used *Diplolepis* as the name of the genus to which *folii* belongs. And most recent authors have followed this practice. Kinsey (1929) uses the name *Cynips* for *folii*, *longiventris*, etc. and I should have followed him if the following difficulties did not arise.

Cynips kollari Hgt. must be, according to Rohwer and Fagan (1927) *Adleria kollari*. The bisexual generation of this gall-wasp is *Andricus circulans* Mayr, as was discovered by Beyerinck (1902, p. 13). To me, being no taxonomist, it is not quite clear in this connection how the species of the genus *Cynips*, e.g. *kollari*, *calicis*, *conglomerata*, *tinctoria*, etc. must be called. In my opinion a solution of the difficulties cannot be obtained until all the species of gall-wasp are treated critically. In the meantime I think it advisable to leave the species *folii*, *longiventris*, etc. in the genus *Diplolepis*, as is usual in Europe since Dalla Torre and Kieffer (1910). At any rate it is quite clear what is meant by *Diplolepis folii*, *longiventris*, etc. and that is the main thing as long as no stability in nomenclature is obtained.

Diplolepis folii and *divisa* may be called of general occurrence in Holland, although their numbers vary greatly one year from another. *D. longiventris* is not so common, but can yet be found all over Holland where oak-trees grow. *D. disticha* is rare and *D. agama* extremely so in this country. Dieckmann (1912, p. 29) mentions the *agama* gall as occurring in Southern Limburg. I also found this gall there in the woods round the village Epen. Moreover, I found the gall in the neighbourhood of the Plasmolen near Mook in Northern Limburg.

Diplolepis disticha has been collected in more places. In the copy of the well-known work by Mayr: „Die Mitteleuropäischen Eichen-gallen in Wort und Bild“ that belonged to M. W. Beyerinck (part II, 1877, p. 38) I found a note in the margin in the characteristic handwriting of this scholar, running: "Wageningen Hill (Wa-

geningse Berg) on a small oak-tree near Oostkant Hotel by the side of the hill-path." Beyerinck must have collected this gall in 1880 or 1881. On the same page he gives a drawing of a longitudinal section of the *disticha* gall. I came upon the gall in Southern Limburg near Epen, in Northern Limburg near the Plasmolen and afterwards on the hills of the Darthuizerberg near Leersum. Dr. G. Kruseman collected the gall near Hooglaren.

Folii, *longiventris* and *divisa* are found on *Quercus Robur* as well as on *Quercus petraea* (= *Q. sessiliflora*). In Holland I only saw the *disticha* and *agama* galls on specimens of *Quercus petraea*. As this type of oak is fairly rare in this country it stands to reason that the two galls occurring on this tree are only rarely met with.

The five galls are affixed on the under-surface of the leaves in the late summer and in the autumn. They drop with the leaves and shortly after the wasps come out. They are the agamic generation of these gall-wasps. It is not difficult to discern the five galls from one another. The same thing cannot be said about the inhabiting wasps. According to Kinsey (1917, p. 91) these are strikingly alike. "If agamic insects alone are available" he says "we would recognize the northern material as one species and the central European as the only other species of the European *Cynips*".

The *folii* gall is the biggest, the section is up to 15 mm. The gall is globular, at first tight and juicy, afterwards rather spongy. The surface is green, often with a red tinge on the side turned to the light. The *longiventris* gall is more flattened globular, up to 10 mm in diameter, hard and mostly reddish and griddled with a number of irregular ridges of a lighter colour, which are granulated. The *agama* gall is the smallest, more oval and yellowish brown, the longitudinal axis diagonally affixed to a strong secondary nerve. The base of the gall shows a groove in which the nerve fits exactly. The *divisa* and *disticha* galls look alike. They are both flattened globular. The *divisa* gall is at first beautifully red, the *disticha* gall is not. The *divisa* gall is rounded off at the top, the *disticha* gall is sunken at the top with a small navel-shaped centre. The full-grown galls of these two wasps are coloured brown. The clearest distinction is seen from a longitudinal section. The *divisa* gall shows one central larval chamber with a hard wall. The *disticha* gall contains two chambers, the upper being empty, while the lower is inhabited by the larva.

The galls of the bigamic generations appear in spring. These galls are known in case of *folii*, *longiventris* and *divisa*. The galls of the bigamic generations of *folii* and *longiventris* develop from cryptoblasts, great numbers of which are found on the bases of oaks and of oak-copse, also on thin one year old twigs and on seedlings. The gall of the spring generation of *Diplolepis folii* is oval, from 3 to 4 mm long and closely covered with purple hairlets. The wasps coming out of these galls are *Diplolepis folii* L. forma *taschenbergi* Schlchtd ♀ ♂. The gall of the spring generation of *Diplolepis longi-*

ventris is somewhat smaller than the former, and coloured grey. This gall is tenanted by *Diplolepis longiventris* Htg. forma *similis* Adl. ♀ ♂. The galls of the spring generation of *Diplolepis divisa* develop from ordinary buds and are attached to the young leaves when these have just come forth. When I bred this wasp in my garden at Bussum in 1899 I got beside the normal leaf-galls also a few specimens which were fixed to the male catkins. In the country, however, I never found these stamen-galls. These galls are cylindrical, sometimes more or less like a dumb-bell, from 3 to 5 mm long and up to $2\frac{1}{2}$ mm thick. The outer wall is brownish, greenish yellow or rather more ruddy and covered with short, vesicular hairlets. Owing to these hairlets the galls look granular and glittering, like frosted glass. The gall is affixed to the top of the mid-rib or to one of the strong secondary nerves. The infected leaf remains small, and sometimes it is but slightly developed, so that it looks as if the gall comes forth immediately from the top of a young twig. The wasp reared from this gall has been described by Schlechtendal (1878, p. 389) under the name of *Spathegaster verrucosa* n.sp. Now it is called *Diplolepis divisa* Htg. forma *verrucosa* Schlcht. ♀ ♂.

The bigamic generations of *Diplolepis agama* and *disticha* are unknown. Kinsey (1829, p. 168 and 174) states about the two galls that the wasps of the bisexual generations „inhabit small cell-like galls in the buds or the leaves of oak”. On page 169 he writes : „It is possible that both the adults and galls of the bisexual form (belonging to *agama*) will resemble *divisa* forma *verrucosa*.”

For quite a long time my attention has been directed to the *disticha* and *agama* galls, and have I been breeding the wasps. It was not easy to gather a sufficient amount of material as the nearest place in which they are found, the Plasmolen near Mook, involves a long journey by train and tram. I did not find the galls in great numbers until I discovered that they only occurred on *Quercus petraea*. A great number of galls are wanted in order to make it possible to breed a sufficient number of wasps, because they are greatly affected by inquilines and parasites. Kinsey (1929, p. 167) mentions 5 inquilines and 16 parasites from *agama* and 5 inquilines and 17 parasites from *disticha*.

On the Darthuizerberg near Leersum I found not far from my home in 1942 a few isolated well-developed specimens of *Quercus petraea* on which the *disticha* gall was quite common; the *agama* gall was not present. From these trees I could gather enough material for breeding the wasps. In the years 1942, 1943 and 1944 the *disticha* gall might be called quite common, while in 1945 I could collect but 2 specimens after long and intense searching, so that breeding experiments could not be made in 1945.

In October I gathered several hundreds of galls and kept these in wide lamp-chimneys, the ends of which were closed by fine netting. The wasps hatched earley in November. Large nettings

were bound over 5 years old shrubs of *Quercus petraea* and several wasps were let loose in them. At the same time wasps were released in a spacious terrarium, which contained young specimens of the same oak in pots. As is always the case with agamic wasps the *disticha* females began immediately to lay eggs. For that purpose they did not seek the cryptoblasts as the *folii* and *longiventris* wasps do, but the ordinary winter-buds. From this might be concluded that the galls of the digamic generation of *Diplolepis disticha* do not correspond with the *taschenbergi* or *similis* galls.

Although for several days I observed the wasps about and busy in the buds not a single gall could be found in the spring of 1943, so that the result of the experiment was negative. On the trees from which I had collected the *disticha* galls, however, I saw several specimens of a small gall, which was identical with the well-known gall of *divisa* forma *verrucosa*. In the neighbourhood of the *Quercus petraea* trees, however, were several *Quercus Robus* trees on which the *divisa* gall, though in small numbers, were present. Certainty was not obtained that the galls hold the digamic generation of *disticha*.

Also in 1943 I bred a great number of *disticha* wasps and let them lay eggs under a netting in my garden, a thing they readily did. They were busy doing it for many days, so that it might be expected that eggs were laid in many hundreds of buds. The result was remarkably small. In the spring of 1944 one small gall had developed. The gall was exactly the same as the specimens that I had collected on the *petraea* trees in the place where they originally had been found. Also in 1944 I collected many specimens of this small gall in the same place, and from them bred a number of males and females. These copulated and the females laid eggs in the young leaves of *Quercus petraea* in my garden, but without any result.

In the autumn of 1944 I collected again hundreds of *disticha* galls and threw the leaves with the galls affixed to them under the *petraea* shrubs in my garden. The next spring three specimens of the new gall appeared. Since *divisa* galls were not present in the surroundings of these shrubs it may safely be assumed that these galls contained really the bigamic generation of *disticha*.

It is remarkable that the experiments with the wasps of the *divisa* gall succeeded far more easily. This had turned out as early as 1899 during breeding experiments in my garden at Bussum, when I began with this kind of work and was quite unexperienced. Moreover, a number of *divisa* galls which had been closed in a netting on the branches of *Quercus Robur* in 1935 gave numerous *verrucosa* galls the next year. The wasps obtained from them laid eggs on the leaves and in the autumn of 1936 appeared several *divisa* galls. Adler (1881, p. 192) stated that he had made no experiments with the *verrucosa* wasps, but was nevertheless convinced

that the *verrucosa* gall contained the spring generation of *Diplolepis divisa*.

The gall that is inhabited by the bigamic generation of *Diplolepis disticha* is identical with the *verrucosa* gall. I cannot find any distinguishing mark. The galls are up to 5 mm long and from $1\frac{1}{2}$ — $2\frac{1}{2}$ mm thick. They are more or less cylindrical with rounded top and at the top and the base they are often widened in which case the galls have the shape of a dumbbell. The base of the gall is often fastened round the edge of the leaf. The surface is yellowish brown, yellowish green or red and covered with vesicular hairlets, growing closely together, making the surface granular and glittering. The galls appear when the leaves come out. They are usually situated at the ends of the leaves, at the top of the mid-rib or of the strong secondary nerves. Sometimes the leaf has hardly developed, so that it looks as if the gall is placed on the top of the twig which has just come forth from the bud. It is difficult to find the galls because they are attached to the young, coloured leaves which have not yet unfolded and are standing closely together. This will be the reason that the galls of the spring generation are unknown. The same holds good for the more common *divisa* gall. The *divisa* galls were common everywhere in the autumn of 1939. In the spring of 1940 only a few *verrucosa* galls could be collected after a long search.

The galls live for a short time. About a week after their appearance the wasps come out. In 1944 I collected the wasps of the new gall between May 6th and 9th. These wasps have been sent to a specialist for identification.

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